SOUTHERN CROSS
Trusted Partner of Utilities Everywhere

Emission Quantification (EQ) Surveys in Natural Gas Networks Case Study

ABSTRACT

More and more utilities are moving towards implementing comprehensive methane reduction programs. However, quantifying methane emissions has been challenging – although several technologies do exist to help quantify the emissions flow rates.

No one technology for estimating emissions flow rate or leak detection alone will fit all situations. Sometimes, it will be a combination or a suite of technologies that will need to be tried, proven, and then used in order to implement a sustainable methane leak detection and emissions reduction program. Using these technologies and new digital tools, gas utilities can accelerate, scale, and optimize their methane reduction programs and meet their emissions targets more quickly and efficiently.

For many gas utilities, outsourcing leak detection and emissions quantification services can prove to be quite cost effective. This alleviates the need to purchase and maintain these sophisticated technology platforms and retain skilled personnel.

In particular, Southern Cross' vehicular based platforms (AMLD) mounted with highly sensitive methane/ethane sensors and using advanced analytics is one of the fastest, cost effective and proven method of identifying natural gas leaks over large areas and quantifying emissions flow rates. The data and insights obtained with this method can be used for multiple purposes including augmentation data in pipe replacement programs, pinpointing locations of the leak sources, leak repair programs (LDAR) and overall aid to corporate methane reduction initiatives.

INTRODUCTION

Methane is the major component of natural gas – about 95% percent. It is also a greenhouse gas. (GHG). There are many reasons to worry about methane emissions. Reducing Methane emissions is the easiest way to reducing overall GHG emissions and have a significant impact on global warming.

Oil, gas, and coal production are anthropogenic or human-influenced sources of emissions. Other anthropogenic sources include landfills, agricultural activities, coal mining and other industrial processes.

CHECK OUT THESE FACTS!

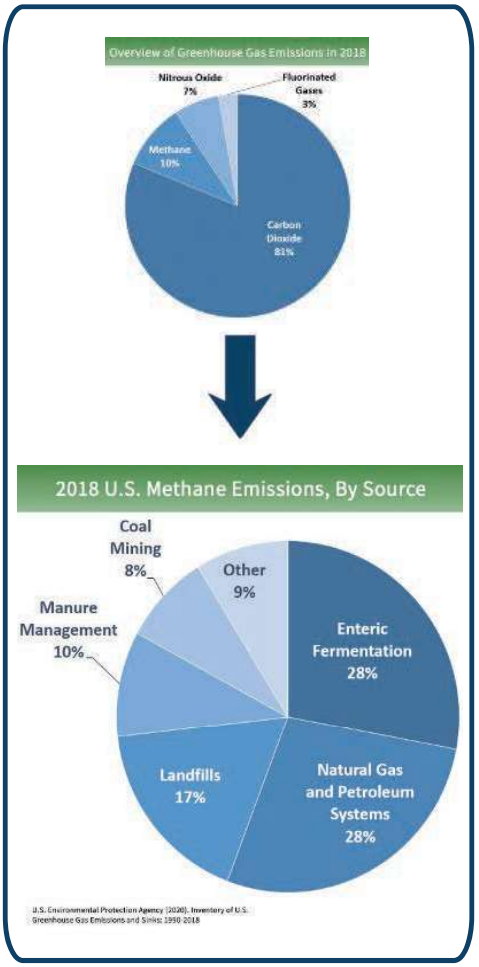
1. Methane (CH4) is a potent greenhouse and represents about 10% percent of all anthropogenic GHG emissions. It has a relatively short lifespan in the atmosphere – about 12 years but has the potential to trap heat in the atmosphere far greater than carbon dioxide.

2. Methane has the capability to trap over 80 times more heat in the atmosphere more immediately and intensely than carbon dioxide (CO2).

3. Natural gas as such, represents about 25% to 28% percent of the total methane emissions.

4. Some sources claim that nearly 20% to 25% percent of the current global warming can be attributed to manmade methane emissions.

5. In the United States, each year fossil fuel companies release about 13 million metric tons of methane into the atmosphere during the course of their normal operations.



WHY IS KNOWLEDGE OF METHANE LEAKS AND EMISSIONS FLOW RATES IMPORTANT?

Why is knowledge of methane leaks and emissions flow rates important?
Of course safety is number one. But apart from environmental harms caused by unchecked methane emissions, there are two other main reasons.

The **first reason** is that gas utilities by law have to conduct compliance gas leak surveys on a regular basis. Today, a majority of this work is done by what is known as “walking surveys”. That is, a technician is dispatched to certain locations and they then survey the mains, the service lines and the meter sets for any leaks and then grade these accordingly. If a repair is needed the appropriate repair crew is informed and the repair is taken care of.

The **second reason** is that by knowing the emission flow rates in their networks, gas utilities can use this data into their pipeline replacement models by ranking and prioritizing on which pipe segments need to be repaired and in what order. This type of ranking allows gas utilities to mitigate risk – in essence repair those leaks with high emission flow rates first (safety and ROI considered) and then the others.

As is common knowledge in the gas industry, a small number of leaks contribute for the majority of the emission losses. Thus, knowing where the leak sources are, and their corresponding emission flow rates is very useful in order to make cost effective pipeline repair decisions and avoid financial losses.

CHALLENGES

There are many challenges to implementing a consistent methane reduction program.

Some of these challenges include:

- Cost can be a major impediment. Procuring these newer technology platforms and having skilled personnel withing the organization can present a challenge – especially for smaller organizations with limited budgets.
- Lack of clear priorities from the C-suite leadership. Given a multitude of priorities an organization can face, methane reduction initiatives may not be high on the priority list.
- Lack of interest and push from investors and general public.

APPROACHES TO ESTIMATING METHANE EMISSION FLOW RATES

The most accurate way to measure emission flow rates is to use a flow meter directly over the leak source. However, this method may not be practically in many cases. The leak source may be in an inaccessible area or we practically cannot fit the flow meters over the leak source due to lack of clearance and other operational hindrances.

Another way to get reasonable estimates is to measure the concentration of methane at locations downwind of the actual leak source and then use these measurements to obtain a reasonable estimate of the methane emission flow rates using one of the several plume modelling algorithms. Data on methane concentrations can be collected using several technology platforms such as UAV, Satellites, Airborne, and vehicular based platforms mounted with suitable sensors to mention a few.

In any case, it is important to realize that all of these quantification algorithms will only give estimates of the methane flow rate. There will always be some uncertainties in the calculations due to a number of factors.

GENERAL METHANE LEAK DETECTION AND EMISSION QUANTIFICATION WORKFLOW

The key to implementing a successful methane reduction program is having sufficient accurate, and reliable data about the location and size of the leaks. In general, most methane reduction strategies demand the following steps:

1

Collect Data

This can be accomplished in any number or combination of the technologies available today. The Mobile Vehicle Based Leak Detection and Emission Quantification platform (AMLD) lends itself quite well for this data collection stage.

2

Sourse Identification

Identify the location of the leaks from the data collected. Analysis becomes much easier if the area under consideration is divided into small grids or polygons – say one mile by one mile.

3

Estimations

Estimate the emission of methane by grids or polygons.

4

Ranking and Risk Mitigation

Rank by polygon and then rank by leak size within the polygon.

5

Actionable Fixes

Fix the “cost effective” significant leaks by certain payback criteria such as value of lost gas versus repair costs or other suitable payback criteria.

CASE STUDY

Emissions Quantification Results - Sample Report

PROJECT OVERVIEW

In this report, you will find an overview of Southern Cross’ Advanced Mobile Leak Detection (AMLD) Solution performed for the client by our Southern Cross team members. The purpose of this project was to quantify the methane leak emissions flow rates in a multitude of polygons/grids.

AMLD PLATFORM OVERVIEW

New sensors with parts per billion (ppb) detecting capabilities and accompanying software in data analytics and prediction, gives an unparalleled ability to now detect natural gas in extremely small quantities (parts per billion) and from a distance.

Utilizing environmental data such as wind speed and direction, GPS tracking and other factors, these new technologies enable us to provide high quality surveys with accurate pinpointing and emission quantification capabilities. Using advanced data analytics, one can quantify the emissions and leakage from the gas infrastructure to enable a utility to conduct risk mitigation, pipeline replacement programs and overall GHG reduction initiatives.

The methodology used in such systems is as follows:

DATA COLLECTION

Raw Data is first collected. Driving is the most efficient means of data collection. (CH4 Concentrations, GPS, Wind Speed/Direction, Vehicle Speed, etc.)

DATA ANALYTICS

Raw data is then analyzed and consolidated using big data analytics and algorithms.

ACTIONABLE SURVEY

Actionable Information is then generated such as location of the leak source or an estimate of a leak's emission rate. Technicians (boots on the ground) can then be dispatched to the leak source for further investigations.

Southern Cross' AMLD platform measures atmospheric, meteorological conditions, and methane plume signatures and utilizes dynamic algorithms to compute the likely location and emissions rates of natural gas leaks while screening out false-positive indications. Combining information from multiple measurement sessions run over the same region, our AMLD solution takes advantage of varying atmospheric conditions (wind direction, wind speed, atmospheric stability) to produce aggregate results that provide comprehensive territory coverage and peace of mind for our clients.

Once the vehicle has performed the drive across the entire territory and data has been collected, powerful analytics are then used to combine the data, removing duplicate and false-positive indications to produce outputs that can be used for analysis and follow up in the field. These results can be utilized for either leak survey or other asset integrity management activities.

Coverage data from multiple drives through an area is processed later and is used to ultimately narrow down where traditional surveying needs to be performed based upon what the analytics system calculates in the environment. This data gives Southern Cross the ability to estimate leak density and emissions – the gas flow rate (cubic feet per hour) – of individual leaks or collections of leaks.

The GPS and Anemometer mounted to the top of the vehicle work together to measure atmospheric and meteorological conditions while pinpointing the location of an indication.

Inlet tubes on the front of the vehicle pull in air that is transported to the sensor at the back of the vehicle where gas is detected and measured.

Workflow

The data collection portion of the emission quantification project began June 1st and ended August 15th. Throughout the ten weeks, one AMLD technician performed the nightly drives five nights per week, weather permitting. The drives began an hour after sundown to ensure the best practical conditions for the data collection.

The AMLD technician performs the survey by driving down both sides of the street, as close to the curb as possible. The vehicle typically travels between 15 and 20 mph. Throughout the nightly 8-hour window the technician was able to drive multiple polygons per night with multiple passes per polygon. These passes were then repeated the following night to ensure data accuracy.

Over the course of ten weeks, Southern Cross surveyed 220 miles of pipeline, divided into 52 polygons to provide a comprehensive picture of the integrity of the utility's pipeline. Utilizing highly sensitive instruments with sonic anemometer, GPS and a secure cloud-based storage, Southern Cross was able to collect the necessary data to provide the client with an estimate of methane emissions per polygon.

Epsilon Gas EQ Survey Project Results

From the survey data, Southern Cross was able to analyze and provide our client with the following metrics:

1. Estimated Total Emissions Flow Rate (L/Min)
2. Estimated Emissions Flow Rate per Mile (L/Min/Mile)
3. Rank by Estimated Emissions Flow Rate per Mile (L/Min/Mile)

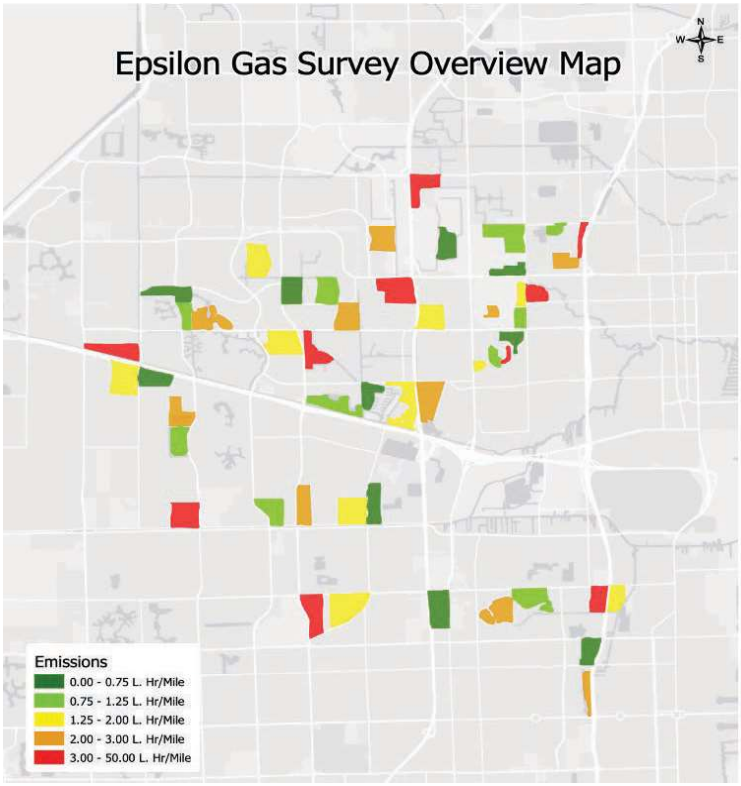
In the enclosed sample report, you will find an overview of a few polygons. Each polygon shows the client's assets as well as Southern Cross' route of data collection.
The polygons are color coded to reflect which emission L. HR per mile group it falls under.

SAMPLE METRICS TABLE:

Polygon	Estimated Total Emissions Flow Rate (L/Min)	Main Length (miles)	Estimated Emissions Flow Rate per Mile (L/Min/Mile)	Rank by Estimated Emissions Flow Rate per Mile (L/Min/Mile)
1	2.10	4.12	0.51	14
2	4.40	5.31	0.83	9
3	3.90	6.86	0.57	13
4	6.99	7.52	0.93	8
5	8.77	8.20	1.07	7
6	5.67	2.06	2.75	4
7	9.20	1.40	6.57	1
8	2.33	3.76	0.62	12
9	4.51	5.45	0.83	10
10	5.34	4.05	1.32	5
11	16.70	2.56	6.52	2
12	12.71	4.32	2.94	3
13	7.65	6.54	1.17	6
14	3.86	4.92	0.78	11

Epsilon Gas EQ Survey – Overall Heatmap

The color coded heatmap for the selected survey area is shown below:



CONCLUSIONS

The above case study has provided some sample results of the Emission Quantification Survey (EQ Survey) conducted by Southern Cross for one of its clients using its AMLD platform. Using this technology, organizations can accelerate, scale, and optimize their methane reduction programs.

With these new digital tools, organizations can meet their emissions targets more quickly and efficiently and use the results to in their pipe replacement and repair programs. Ranking the emissions flowrates by polygons or grid allows for identification of the high emitting sources that can be targeted for repairs first.

For many gas utilities, outsourcing leak detection and emissions quantification services can prove to be quite cost effective. This alleviates the need to purchase and maintain these sophisticated technology platforms and retain skilled personnel.

Southern Cross is able to provide comprehensive leak detection and methane emission quantification programs for gas utilities of any size. Furthermore, we are able to generate location of the leak sources and provide skilled technicians for any further investigations or repair work.

Sample Individual Polygons

Some of the color code sample polygons overlayed with assets are shown below:

AUTHORS

Alnoor Ebrahim
Product Marketing & Strategy

Jordan Ponizhaylo
Marketing Specialist

SOURCES

1. Overview of Greenhouse Gases | Greenhouse Gas (GHG) Emissions | US EPA
2. Methane: Everything You Need to Know | Earthjustice
3. Methane: The other important greenhouse gas | Environmental Defense Fund (edf.org)
4. Global Methane Emissions and Mitigation Opportunities

LET'S GET STARTED.
Contact us today!

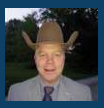

Parker Jones
Account Executive
Pjones@southerncrossinc.com
Tel: (415) 489-8402


Jody Boyles
VP of Sales & Business Development
Jboyles@southerncrossinc.com
Tel: (919) 799-3701


Joe Mandara
Regional VP Operations
Jmandara@southerncrossinc.com
Tel: (917) 567-2250


Steve Whitman
Account Executive
Swhitman@southerncrossinc.com
Tel: (256) 496-0249


Bob McArthur
Business Development Manager
Robert.mcarthur@southerncrossinc.com
Tel: (501) 351-6836


Tim Jackson
Account Executive
Tjackson@southerncrossinc.com
Tel: (470) 244-9364


Roy Haynie
Account Executive
Roy.haynie@southerncrossinc.com
Tel: (480) 266-8020

ABOUT SOUTHERN CROSS

Since 1946, Southern Cross has been an industry leader in providing pipeline safety and other field services. Today, Southern Cross continues to provide field service solutions to the gas, electric, water & energy/oil industries. Our services include traditional leak survey and inspections, meter deployments including AMI/AMR, locating, professional services such as project management and project controls, and much more. Southern Cross is dedicated to remaining at the forefront of our industry's technological advancements and we are constantly innovation our solutions and methods. Proud of our rich history, confident about our current offerings, and excited for what's next, Southern Cross upholds our reputation as a ***"Trusted Partner of Utilities Everywhere".***

www.southerncrossinc.com

Linkedin.com/company/southerncrossinc

Facebook.com/southerncrossinc

@SouthernCross70

@Southerncrossinc